DOCUMENT RESUME

ED 335 503 CE 058 667

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TITLE The Relationship between Method of Clinical Instruction in Radiography and Scores on the American Registry of Radiologic Technologists Certification Examination.
PUB DATE Jun 91
NOTE 40p.; Practicum report, Nova University.
PUB TYPE Dissertations/Theses - Practicum Papers (043)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Allied Health Occupations Education; Clinical Experience; *Clinical Teaching (Health Professions); Community Colleges; Competency Based Education; *Correlation; Educational Research; Entry Workers; Job Skills; Literature Reviews; *Radiographers; *Radiologic Technologists; Scores; *Simulation; *Student Certification; Student Evaluation; Teaching Methods; Two Year Colleges
IDENTIFIERS Lincoln Land Community College IL

ABSTRACT

An examination was made of the relationship between clinical grade based on simulation and a subsequent outcome measurement, the national certification examination in radiography. Although the new "Essentials" developed by the Joint Review Committee in Education in Radiologic Technology discouraged use of simulation, the method had worked well for the radiography program of Lincoln Land Community College (Illinois). Seventeen graduate radiographers from 1984-89 comprised the sample group. A literature review focused on three concepts: (1) clinical competency in the field of radiologic technology; (2) use of simulation as an evaluative and teaching tool in the health professions; and (3) the relationships between independent variables and the dependent variable of registry score. The Pearson product-moment correlation coefficient (r) was used to establish the relationship, with a significance of 0.05 set for the study. The calculated value of r was 0.966, which would be significant at a p 0.01. Since the number of cases was under 30, the Spearman rho was also calculated, giving an r of 0.988, also significant at a p 0.01. The relationship between clinical grade based on simulation and subsequent registry score was found to be significant. Retention of simulation as the program's method of clinical evaluation and future study to validate the results were recommended. (Thirty-six references are listed. Distribution scores are appended.) (YLB)

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THE RELATIONSHIP BETWEEN METHOD OF CLINICAL INSTRUCTION IN RADIOGRAPHY AND SCORES ON THE AMERICAN REGISTRY OF RADIOLOGIC TECHNOLOGISTS CERTIFICATION EXAMINATION .

Research Methodology

by

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A Practicum Report presented to Nova University in partial fulfillment of the requirements for the degree of Doctor of Education

Nova University

June 1991

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THE RELATIONSHIP BETWEEN METHOD OF CLINICAL INSTRUCTION IN RADIOGRAPHY AND SCORES ON THE AMERICAN REGISTRY OF RADIOLOGIC TECHNOLOGISTS CERTIFICATION EXAMINATION

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Steven B. Dowd

June, 1991

The use of simulation is discouraged in radiography by the *Essentials* for accreditation. Currently, the radiography program sponsored by Lincoln Land Community College uses simulation for clinical evaluation. This study attempted to establish a relationship between clinical grade based on simulation and a subsequent outcome measurement, the national certification examination in radiography. Seventeen graduate radiographers comprising five years worth of released scores were used as the sample. The Pearson product-moment correlation coefficient (r) was used to establish the relationship, with a significance of 0.05 set for the study. The calculated value of r was 0.966, which would be significant at a $p < 0.01$. As the number of cases were under thirty, the Spearman rho was also calculated, giving an r of 0.988, also significant at a $p < 0.01$.

The relationship between clinical grade based on simulation and subsequent registry score was found to be significant, and it is recommended to retain simulation as the program's method of clinical evaluation. Future study is also recommended to further validate the results.

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Chapter 1

INTRODUCTION

Background and Significance

The goal of the ARRT (American Registry of Radiologic Technologists) radiography examination is the assessment of "knowledge and cognitive skills underlying the intelligent performance of the major tasks typically required of an entry level staff technologist"(Educator's Handbook, 1987). The Registry performed a job analysis project that documented the linkage between typical entry-level tasks and the content of their examination.

Similary, educational programs accredited by the Joint Review Committee on Education in Radiologic Technology must be compentency-based; that is, students must progress through a system that allows them to exhibit entry-level ability upon graduation.

It seemed reasonable, with the above two assumptions, that registry score in radiography should directly reflect student clinical performance. In physical therapy, Roehrig (1988) noted that "high scores on a licensing examination may not correlate with excellence in clinical skills," a statement that does not seem defensible in the light of competency based education for the allied health professions.

Purpose of the Investigation

The radiography program of Lincoln Land Community College is slightly unusual in that it uses simulation in clinical education to a great degree. Despite the fact that other health professions such as medical and nursing education use simulation successfully, the new *Essentials* developed by the Joint Review Committee in Education in Radiologic Technology call for only very limited use of simulation. This method has worked well for the program for many years.

This investigation examined the relationship between clinical grade as determined through clinical competency simulation and subsequent registry examination score. Five years of program graduates were used (1984 - 1989) as the sample group.

Significance to the Institution

The radiography program sponsored by Lincoln Land Community College, a comprehensive community college in Springfield, Illinois, has enjoyed full accreditation of its radiography program for many years. Offered in conjunction with St. John's Hospital, an 800-bed teaching hospital also located in Springfield, the program is offered in a very cost-effective manner through co-sponsorsip.

Under the new *Essentials*, two options exist for the program. The program could hire an additional clinical instructor, with costs assumed by one or both institutions. However, if the method of instruction can be validated then the program can justify the method in the next review cycle. As the

new *Essentials* are strongly outcome-based, this could be done through a casual-comparative, ex post facto study.

Relationship to the Seminar

The purpose of the seminar in Research Methodology is to "assist the student to obtain the skills and to understand the need for identifying, analyzing, and solving problems related to their place of employment" (Research Methodology Study Guide, Fall 1990). The purpose of the study here will be to use the skills gained in this course in a practice setting.

Research Question

Do grades based on simulation as a method of clinical instruction relate to subsequent ARRT examination score?

Research Hypothesis

Grades based on simulation will correlate positively with subsequent registry examination score.

Definition of Terms

ARRT - Short for American Registry of Radiologic Technologists, this organization develops and administers the voluntary certification examination for radiographers, radiation therapists, and nuclear medicine technologists graduating from programs accredited by the Joint Review Committee on Education in Radiologic Technology.

Certification exam - Used interchangeably here with "registry examination" and refers to the examination commonly used to certify practitioners in radiologic technology.

Clinical competency - A method of assessing the clinical, or patient care, skills of students. In radiography this refers to procedures necessary to produce a diagnostic film and maintain patient integrity.

Competency based - A method of instruction and evaluation that focuses on behaviors or sets of behavior that students must be able to demonstrate upon graduation. Competencies must reflect knowledge, skills, and attitudes required of entry-level professionals (Broski,1976).

Criterion referenced - A test where the observed behavior itself is the measure (or *criterion*) for success. It provides information as to what behavior the student possess at the time the test is administered (Harriman, 1980).

Essentials - Short for *Essentials and Guidelines of an Approved Program for the Radiographer* and developed by the accrediting body for radiologic technology, the Joint Review Committee on Education in Radiologic Technology.

Norm-referenced - A test that indicates how a student's test performance compares to that of students who comprise the normative group (Harriman, 1980).

Radiologic technology - A professional group consisting of *radiographers*, who use x-radiation to produce a diagnostic film; *nuclear medicine technologists*, who inject radioisotopes into the body to diagnose and treat disease; *radiation therapists*, who use radiation to treat cancer and other

malignancies; and *ultrasonographers*, who use high-frequency sound to produce diagnostic images.

Simulation - Defined by Matuscak (1983) as "attempts to re-create real-life situations." These refer to a variety of patient care situations in which a student or other individual takes on the role of a patient to simulate the performance of patient care tasks.

Chapter 2

REVIEW OF THE LITERATURE

Introduction

This review of the literature will consist of three basic sections. First, clinical competency in the field of radiologic technology will be discussed. Then literature relative to the use of simulation as an evaluative and teaching tool in the health professions will be reviewed. Finally, although the value of simulation has not been evaluated in radiologic technology, articles have been published focusing on factors that affect certification exam score in radiologic technology. These will be reviewed as a comparison.

Clinical Competency

Clinical competency evaluation is a method of standardizing the evaluation of a student radiographer's performance in the clinical setting (Ireland, 1986). "Clinical" refers to all patient care skills needed by students to perform an examination and maintain patient integrity. "Competency," as defined earlier by Broski (1976), refers to a method of instruction and subsequent evaluation that focuses on behaviors or sets of behavior that students must be able to exhibit upon graduation. Palmer, Short, and Geren (1978) note that "task analyses and didactic and clinical performance objectives make it possible to define cognitive, affective, and psychomotor skills and behaviors necessary to become a successful radiologic technologist." Harriman (1980) notes that a strong focus on

competency is essential in allied health as "the antithesis is disaster."

Clinical competency is one portion of a student radiographer's clinical education and evaluation, which consists of four broad categories: knowledge, technical skills, interpersonal skills, and habits and attitudes (Irby and Dohner, 1976). The American Society of Radiologic Technologists (ASRT) has developed a criterion-referenced clinical competency evaluation form through a task analysis (ASRT, 1979; Harriman, 1980). Six specific skills must be evaluated:

1. Evaluation of requisition.
2. Physical facilities readiness.
3. Patient/technologist relationship.
4. Positioning skills.
5. Equipment manipulation.
6. Evidence of radiation protection.

Recently, Drafke (1990) has made note of the fact that colleges and students often take a dim view of pass/fail courses. Thus, most programs have combined the criterion-referenced ASRT form with a variety of norm-referenced strategies. Isaac and Michael (1983) state that it is possible for tests to be both norm- and criterion-referenced, but that this is rare due to the narrow focus of criterion-referenced tests. It would appear that the specific needs of criterion-referenced evaluation in radiography (a competent practitioner) must be balanced with the broad needs of individuals and institutions (providing grades).

Simulation and Clinical Competency

It is commonly believed that, without production of a film using a "real" patient, clinical competency in radiography cannot be assessed. As mentioned earlier, the new *Essentials*, in the section on Curriculum, call for the very limited use of simulation. It says that, "Simulation may be utilized for infrequent or limited volume examinations. Simulation should comprise a minor component of clinical evaluations."

A similar comment can be seen in the professional literature. In the radiologic sciences newsweekly RT Image, Malinowski (quoted in Riemenschneider, 1990), in discussing clinical competency, states bluntly that, "It's not a competency unless it's a real patient." Key (1989) has also stated that simulation "does not allow the student to see the result of making an actual exposure."

However, the medical, nursing, and allied health literature has been uniformly positive regarding the use of simulation in proving clinical competency of students. A review of the *Silver Platter* database (*Cumulative Index of Nursing and Allied Health*) for the time period of 1983 to February 1991 revealed eighty-five articles discussing the use of simulation, with twenty-seven of those related to clinical education.

In medical education, Barrows in 1964 described the use of simulated or programmed patients in assessing medical students' competency in a neurology rotation. In 1971, he wrote what is considered to be a classic text devoted entirely to the use of

simulated patients. In a 1980 text, he stated that "any type of patient problem can simulated from the straightforward to the bizarre."

Saunders and Ruvolo (1981) used simulation in the field of physical therapy to develop a "Mock Clinic" at the University of Wisconsin - La Crosse. This "rotation", developed in response to the lack of "real" rotations available to students, simulates a real-life physical therapy department. The student taking on the role of therapist selects a patient treatment card containing specific instructions. A student selected to be the patient is instructed by the clinical supervisor in proper patient behavior. After each session, a group review is held.

In a general review article on clinical competency in allied health, Matuscak (1983) felt that allied health schools were relatively slow in developing simulated activities as compared to nursing and medical schools. One problem - also noted by Saunders and Ruvolo - is the initial time commitment required by faculty to develop appropriate simulations. Nursing and medical programs are generally well-entrenched in the institution, whereas allied health programs are often seen as marginal and have a higher student/faculty ratio. This leaves less time for innovation.

McDowell et al. (1983), nurse practitioner educators, note the problems that the use of "real" patients brought about:

- Patients were often either "too easy" or "too sick" for the level of skill to be evaluated;

- Students sometimes exhibited excessive anxiety;
- Faculty involvement had a tendency to become negative; that is, they became involved in the procedure to not compromise patient care;
- Specific areas of strengths and weakness were difficult to spot in "real" encounters; and
- Faculty felt that "other" variables often influenced them in evaluation.

Kolb and Shugart (1984) feel that there are three links of clinical competency:

- The often unmanageable reality of the real world;
- The manageable reality of modified settings (eg., screened patient encounters); and
- The instructional reality of simulations - mannequins, role play, simulated patients, peer patients, simulation games, and computer aided instruction.

Their conclusion was that, although the use of simulation was no "panacea", it had wide ranging use, if properly evaluated.

In nursing, one very exciting and recent use of simulation has been in the area of computer simulations. Boswell (1988;1989) has described two such computer programs in a nursing journal devoted to microcomputers. Unfortunately, in the field of radiologic technology, most available computer software is simply still "automated flashcards" (Dowd, 1990).

A text describing innovative methods for teaching nursing (Fuszard, 1989) devoted five of twenty-one chapters to the use of

various methods of simulation. Most notable is Morse's (1989) use of the Portable Patient Problem Pack (P_4), a teaching-learning method that presents factual material as it teaches clinical problem-solving. Simulated patient management problems are presented in a card-selection format, and the user must select relevant color-coded cards that correlate to the assessment, treatment, and evaluation of the patient problem.

Another very exciting recent use of simulation involves the assessment of critical thinking skills in relation to clinical decision making. Brooks and Shepherd (1990) found a "weak but significant" positive correlation between clinical decision making and critical thinking using the Nursing Performance Simulation Instrument and the Watson-Glaser Critical Thinking Appraisal.

Only one article in the radiologic technology field has described the use of simulation in even a preliminary way. Dowd (1990) noted that the lack of a film in terms of an outcome is the usual argument against simulation. Yet it would seem that a trained instructor would be able to, based on the strict psychomotor, cognitive, and affective objectives set down for the profession, evaluate a simulated experience effectively. The use of computer technology is another issue that should be explored in the field; that is, what kinds of simulated patient care experiences can be provided to students through the use of a microcomputer?

Factors Affecting/Related to Certification Scores in Radiologic Technology

Ballinger (1976) performed one of the early studies correlating ARRT score to various factors such as ACT English score, high school math background, and high school grades in various subjects. He found that high school rank was the most significant predictor, with ACT English score the second most significant predictor (HS rank = 0.45; ACT English = 0.38; 20 df; $p < 0.01$).At that time the ARRT relied on the validity of their exam through a study that compared on-the-job proficiency of graduates to exam scores. This is now outdated due to new exam criteria and the task analysis approach mentioned earlier.

Weinstein (1981) could find no correlation between faculty qualifications and registry score. Lauer (1981) examined six manipulable factors, such as number of clinical hours completed, and was unable to draw any correlation between these factors and registry score. Lance and Harp (1987), in the sub-field of nuclear medicine, found SAT math scores and college GPA to be the strongest predictors of performance on the ARRT nuclear medicine exam using the Pearson product-moment correlation coefficient (GPA = 0.381; SAT-M = 0.258; 40 df; $p < 0.01$). SAT verbal scores were not significant as their third independent variable.

The use of a "mock registry", or simulated registry exam, has found great favor in the field of radiologic technology. Interestingly, there are more books devoted to the passage of the

ARRT exam (eg., 1001 Questions About Radiologic Technology by Roy Bell, 1983) than any other subject. Macomber and Sanders (1984) found mock registry to be a superior predictor of subsequent ARRT exam performance than GPA (Mock = 0.693; GPA = 0.472; 103 df). Mock registry was significant at the 0.01 level; GPA would not be significant until the 0.10 level.

The most recent analysis of the relationship between ARRT exam score and an external factor has been Francis' (1990) analysis of ACT test results in relation to ARRT score. He found a strong positive correlation between ARRT score and ACT exam score ($r = 0.64$; 30 df; $p < 0.01$). This information was used to assign a heavier weight to ACT score in admissions, with failures decreasing by a factor of three in the two years subsequent to the study.

Summary

Three concepts were discussed here: 1). clinical competency in general; 2). clinical competency and simulation; and 3). studies that have focused on relationships between independent variables and the dependent variable of registry score. This provided a conceptual base for the study: the relationship between the independent variable of simulated clinical competency evaluation and the dependent variable of registry score.

Chapter 3

PROCEDURES

Introduction

This was a descriptive study, using the Pearson product-moment correlation coefficient (r) to analyze the relationship between clinical grades based on simulation and subsequent registry score. A significance of 0.05 was set for the study, using five years worth of data (1984 - 1989) on program graduates.

Data Collection

Sample

Five years of released certification exam scores (50 graduates) of graduates from the Lincoln Land Community College radiography program gave seventeen scores. As in the report of Lance and Harp (1987) cited earlier in the literature review , the fact that national certification examination are released by written permission of examinees only limits sample size severely. It is difficult to convince students already apprehensive of failure to release their scores back to the program. Program directors in radiography are familiar with trying to track down "who" failed the test - the ARRT only releases general summary scores and the number passing the exam.

Instrument

The method of simulation used by the program involves having students perform exams in a non-energized laboratory

setting that mimics real-world settings. The evaluation instrument used (Appendix A) is criterion-referenced, based on professional standards established by the ASRT cited in the literature review. It is also norm-referenced in that grades are assigned to discriminate between the "best" students and "poorer" students (Harriman, 1980), a necessary "evil" also noted by Drafke (1990).

Scoring

Students schedule evaluations as needed within the confines of instructor availability. "Clinical Score," as reported in this study, is based on all 47 clinical competency examinations performed by students in the two years in the program. Items that involve "direct" care (that would negate the value of the film or potentially harm the patient) are graded on a pass-fail basis; those that would detract from effective patient care or compromise the film are graded on a percentage scale, with seventy percent being a minimal passing score.

The grading system is listed in Table 1. Grades are assigned on a sliding scale once failed; penalities are assigned for each failure. Thus a "perfect" score on a second attempt is assigned a grade of ninety-five percent in addition to the sixty percent grade assigned to a failure. Then a "perfect" attempt on the second try translates into a composite score of seventy-seven

percent (95 + 60 divided by 2 = 77.5%). Also, further progress is not allowed if the student reaches seven attempts and has a score of less than perfect. Table 2 shows the relationship between attempts and scores earned.

Table 1

Program Grading System

Grade	Score (%)
A	93 - 100
B	85 - 92
C	84 - 75
D	74 - 70
F	69 and below

Table 2

Clinical Competency Scoring System

Attempt	Beginning Percentage	Composite
1	100	100
2	95	77.5
3	90	75
4	85	72.5
5	80	70
6	75	67.5
7	70	65

Data Presentation

Appendix B lists distribution scores for the *dependent* variable of registry examination score and the *independent* variable of clinical evaluation. These are listed in sequential order, from highest clinical score (97) and matching registry score to lowest clinical score (84) and matching registry score.

Treatment of Data

The computer program *Protab* was used to analyze the data. This program is able to perform a Pearson product-moment correlation coefficient by disk or manual entry, and is also able to perform a prediction analysis of the dependent variable based on the independent variable.

In the profession of nursing, Knapp (1985) has asserted that the Pearson product moment correlation coefficient (r) is applicable in determining the degree of association between students' clinical performance scores and nurse licensure exams. It is logical to assume that the same correlation exists in radiography.

Null Hypothesis

H_0 = There is no relationship between grades based on simulation (*independent* variable) and subsequent ARRT examination score (*dependent* variable).

Assumptions and Limitations

1. It is assumed that there is a match between the outcome or *dependent* variable and the process of clinical instruction/evaluation or *independent* variable. It cannot be assumed that the method of evaluation caused the registry score based on a correlation coefficient, simply that a relationship exists (King, 1976). Isaac and Michael also note that casual-comparative research showing that two factors are related does not necessarily imply that a cause and effect relationship exists. They may simply be related to an additional factor not recognized or observed; for example, "good" clinical students may also be "good" classroom students - which would correspond to a subsequent high registry score based on cognitive ability.

2. The small survey sample increases the possibility of committing a Type I or Type II error (Isaac and Michael, 1983). Thus the study should be viewed as preliminary.

3. The results of this study can only be generalized to those representative of the survey sample, i.e., radiography students in the Lincoln Land Community College Program.

4. The fact that scores were released only by a small group of students raises the question of self-selection. That is, only those students who felt confident of passing may have released their scores. However, this program only experienced four failures in the five years worth of data; one of these is included here (a score of less than seventy-five percent).

Chapter 4

RESULTS

Table 3 summarizes the measures of central tendency of clinical scores and registry scores. Table 4 summarizes the computation of the Pearson product-moment correlation coefficient (r) by the computer program *Protab*.

Table 3

Measures of Central Tendency

	Clinical Scores(%)	Registry Scores(%)
Mean	92	84
Mode	94	84
Median	92	84
Range	97 - 84	94 - 73
Standard Deviation	3.89	5.12

Table 4

Pearson Correlation Analysis Data

As Calculated by *Protab*

r =	0.966050
rSquare =	0.933253
StdErr =	1.358625
df =	15
t Ratio =	14.481976
p =	p < 0.01
Slope =	1.270345
Y Intersect =	32.246897-

The calculated correlation coefficient of 0.966 indicated a high degree of positive relationship between clinical and registry scores. This bivariate distribution corresponded to an almost perfect positive correlation.

According to Isaac and Michael (1983), with fifteen degrees of freedom (df = N - 2, with N being the number of pairs of scores), a value of 0.482 would be significant at the 0.050 level. To be significant at the 0.010 level a value of 0.606 is necessary. Thus the value exceeded the significance set for the study.

As the number of pairs was less than thirty, and Isaac and Michael note that when this occurs, the Spearman rho is often used, this statistic was also calculated based on the guide in their text. A value of 0.988 was calculated, which would also be significant at the 0.01 level.

Chapter 5

DISCUSSION, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Discussion

In a preliminary manner, simulation was shown to have a relationship to subsequent registry score. This relationship exceeded a p of 0.01, as did the studies of Ballinger (1976; High School rank and ACT English score); Macomber and Sanders (1984; Mock registry), Lance and Harp (1987; College GPA and SAT math), and Francis (1990; ACT score).

Conclusions

Simulation would appear to be an acceptable method of clinical instruction. No contradictory evidence was found in the literature (beyond opinions) and this appears to be the first study of the relationship between an outcome (ARRT exam score) and the use of simulation in clinical education in radiography. In fact, no study analyzing the relationship between any method of clinical instruction and registry score could be identified in the literature, despite the fact that the test is based on the performance of tasks required of the "entry-level radiographer," as is clinical education. The significance obtained exceeded that originally set forth for the study.

Implications

There does not appear to be any reason to shift the method of clinical instruction from simulation to another method. The now outcome-oriented *Essentials* should allow for the use of alternative methods. An outcome orientation to accreditation should allow the *educator* to develop the process (Casamassimo, 1990). The *how* of the educational process should be internally developed. Casamassimo also feels that outcomes measures are patient-oriented and emphasize basic skills, as well as provide programs with quality assurance in education. These items all are a concern of the program, with this study providing validation of the appropriateness of the method of instruction and program quality.

Recommendations

This study should be updated yearly to amass larger numbers on which to base conclusions. Hopefully, more students can be convinced to release their scores. It might also be interesting to document a comparative study, though this would be difficult given the limited resources available (Fifteen students per year capacity and only one section of each course).

The computer program *Protab* is also capable of performing a predictive analysis based on the correlation coefficient. It can determine, with various degrees of accuracy (99 to 80 percent), the expected score on the registry (dependent variable) based on the independent variable of clinical grade. This will be used for retention information (that is, students with a low clinical grade may not be able to pass the registry and should be encouraged to repeat sections or leave the program, given a sufficiently long record of low scores) as well as provided to the student to help in remediation/study for the registry examination. This must be done with caution, given the inherent danger in the correlation coefficient of allowing a correctly performed prediction to lapse into the incorrect strategy of extrapolation (see, for example, Colton (1979), p. 212).

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APPENDIX A

EVALUATION INSTRUMENT

COMPETENCY EXAM GRADING SHEET

Formula for number of possible points per exam is: **# of views required x 65 + 35 = Total points**

NAME: _____ **SUBJECT:** _____ **DATE:** _____

CATEGORY:	Possible Pts/view where applicable	Pts.subtracted x No. of times	Total Points/ Minus
1. Set up the room prior to taking the patient in			
a. appropriate articles in room	5	_____	_____
b. clean room	5	_____	_____
2. Patient communications			
a. verify patient ID	P/F	_____	_____
b. explain the procedure	5	_____	_____
c. request history with an explanation of the necessity of obtaining it.	4/3	_____	_____
d. record a history	3	_____	_____
3. Remove extraneous items from body part being radiographed	P/F	_____	_____
4. Indicate having the patient in an examining gown if applicable.	5	_____	_____
5. Film/screen			
a. proper film/screen combination	P/F	_____	_____
b. Proper film size: wrong size but anatomy fits	5	_____	_____
c. wrong size-anatomy clipped	P/F	_____	_____
d. Proper placement of the film	5	_____	_____
6. Technique			
a. preset technique	5	_____	_____
b. set proper technique	P/F	_____	_____
c. proper breathing instructions	10 major/5 minor	_____	_____
d. proper placement on the film	10	_____	_____
7. Position the patient properly			
a. knowledge of body position	P/F	_____	_____
b. minor errors positioning body part	5	_____	_____
c. use correct tube/film angle	P/F	_____	_____
d. proper CR locations			
Minor error in CR location	5	_____	_____
Major error in CR location	P/F	_____	_____
e. center the Bucky	P/F	_____	_____
f. proper FFD	P/F	_____	_____

COMPETENCY EXAM GRADING SHEET (continued)

CATEGORY	Possible Pts/view where applicable	Pts.subtracted x No. of times	Total Points/ Minus
8. Collimation			
a. insufficient collimation	5	_____	_____
b. cone cut	P/F	_____	_____
9. Shielding			
a. shield where applicable	5	_____	_____
b. overshield-cover desired anatomy	P/F	_____	_____
10. Markers			
a. not marked or coned off	5	_____	_____
b. marked incorrectly or in area of interest	P/F	_____	_____
11. Manipulate the equipment properly			
a. fumbling	5	_____	_____
b. jeopardizing the patient's safety (cones, stretcher locks, wheel-chair locks)	P/F	_____	_____
12. Demonstrate the ability to determine how/when to repeat a radiograph	5	_____	_____

_____ / _____ = _____ %

STUDENT'S SIGNATURE: _____

OBSERVER'S SIGNATURE: _____

APPENDIX B

DISTRIBUTION SCORES

Distribution Scores

Clinical Score(%)	Registry Score(%)
97	94
97	91
95	90
95	88
94	87
94	86
94	85
93	85
92	84
92	84
91	84
91	83
91	82
87	80
86	78
85	77
84	73